THE GRAND ERUPTION OF VESUVIUS IN 1906[1]

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Historical.—From the writings of Plutarch and Strabo we know that previous to the Christian era where now is the complex cone of Vesuvius, with its Atrium and Somma, the latter alone existed, though in the form of a complete ring. This Strabo believed to be a volcanic crater, though extinct. From the time of the earliest Greek colonization no records have been preserved of any eruption in this crater previous to the eventful year of 79 A. D.; though attention has been drawn to the fact that wall-paintings recovered from the buried cities of Pompei and Herculaneum represent the Somma of those days with a somewhat broken wall as though from an eruption. The careful studies of Johnston-Lavis have shown, however, that in the composition and structure of Somma there is the record of no less than fourteen periods of eruption, and of two long intervals of repose not unlike that which immediately preceded the Christian era.[2]

The eruption in the year 79, the greatest of Vesuvius within historic times, was of the explosive type, producing no streams of lava, but supplying such a vast quantity of lapilli and ash that, carried by the *tramontana* then blowing, it was distributed over the cities at the southern base of the mountain and along the slopes of the Sorrentine peninsula. Pompei was covered in places to a depth of 25–30 feet by this material; while the populous city of Herculaneum, situated at the bottom of a steep slope, was overtaken by a flood of mud and ash and buried beneath 60 feet of débris, now augmented by lava streams from later eruptions. The vast quantity of ejected material transferred the coast line from the former port of Pompei to near its present position, reduced the ancient crater

[1] This article was dispatched from Rome a fortnight after the eruption. Various causes have prevented its earlier publication.

[2] H. J. Johnston-Lavis, *Eruptive Phenomena and Geology of Monte Somma and Vesuvius in Explanation of the Great Geological Map of That Volcano* (London, 1891; pp. 21).

of Somma to its present fragmentary form, and laid the foundations of the inner cone—Vesuvius proper. The letters of Pliny the Younger to Tacitus describe the cloud above the crater during this eruption as resembling a great pine (from which the canopy form of the stone pine must be understood), and this simile has ever since served for illustration.

Of the eight eruptions which are recorded between 79 and 1631 we know but little,[1] and the chief interest attaches to the long period of repose which, except for a slight ash eruption (1500), extended over nearly 500 years (1139 to 1631). During this time the crater was forested and overgrown with vines, as it had been for a long time previous to 79; and it is of considerable interest to note that the activity of Vesuvius was in this interim apparently transferred to the Phlegraean Fields west of Naples, where the Solfatara erupted in 1198 and in 1538 a new volcano (Monte Nuovo) formed on the shore of the Lake Lucrinus. Monte Epomeo on the island of Ischia also erupted in 1302.

The greatest Vesuvian eruption of which we have full accounts was that of December 15–19, 1631; which serves as type of the paroxysmal, as does that of 79 for the explosive eruption. This outburst of 1631 began with rumblings within the crater, followed by the opening of a cleft upon the east side of the mountain and the emission of steam and ash. On the following day another fissure opened upon the south side and sent up the characteristic "pine cloud" of steam and ash to overwhelm Nola, Palma, Lauro, and Ottaiano; thus indicating that a southwest wind was blowing as at the time of the present eruption. The climax of this eruption was reached upon the 18th, when lava poured from the crater in four great streams: one of which overran Bosco and Torre Annunziata; a second Torre del Greco; a third Portici and Resina, with the loss of some 3,000 persons; and a fourth Massa di Somma, San Sebastiano, and Sant' Anastasio upon the northwest slope. All streams save the last mentioned precipitated themselves into the sea, where they produced ebullition over a considerable area. It is stated that the cone of Vesuvius was reduced in height by some 170 meters at this time.

[1] The best edited account of these eruptions will be found in the work by Justus Roth, *Der Vesuv und die Umgebung von Neapel* (Berlin, 1857).

The greatest of the subsequent eruptions have occurred in 1737, 1794, and 1822; in all of which outbursts the cone suffered considerable reductions in altitude. In 1855 also it is said to have lost almost 60 meters. In the eruption of 1737 Portici, Resina, and Torre del Greco were all again invaded by lava, as was the latter city in 1794. Of the eruptions which have taken place in 1822, 1839, 1850, 1855, 1861, 1872, 1899, and 1903, much the most important have been those of 1822 and 1872. The last mentioned was of considerable interest because of its rapid development, and because of the favorable conditions which it offered for observing and photographing the mountain. Great quantities of steam were given off; and the lava, which flowed in the direction of San Sebastiano, was typical of the "ropy" surface sometimes assumed by volcanic magmas. In recent years small quantities of lava have for quite long periods oozed from elevated *bocche*.

No volcano has received the same amount of study as Vesuvius, and the greatest amount of accurate knowledge of it has been brought together upon the map of Dr. Johnston-Lavis.[1]

Chronicle of events during the eruption of 1906.—During late September and early October, 1904, Vesuvius was in almost absolute repose. The eruption of lava began May 27, 1905. The charts kept at the Osservatorio Vesuviano to indicate the grade of activity show absolutely no change at the time of the great Calabrian earthquake of 1905 (September 8), the curve of activity for days before and after that disturbance being almost horizontal. In October and November, 1905, lava was dribbling from an outlet high up upon the central cone and near the funicular railway. At night it showed from Naples as a bright red line, which later forked near the Atrio del Cavallo. This stage with the gradual augmentation of activity continued until the first days of April, 1906.

On the 5th of April there was a very decided increase in the violence of the explosions, and an ash cloud mounted high above the crater (see Fig. 6). The climax was reached on the evening of the 7th (Fig. 7), when three earthquakes were felt in Naples of sufficient

[1] Geological map of Monte Somma and Vesuvius constructed by H. J. Johnston-Lavis during the years 1880–88. Scale 1:10,000 (6.33 inches to the mile). In six sheets.

violence to produce considerable panic, but no damage. To this accompaniment of shocks a new mouth or *bocca* opened near the shoulder of the mountain (the *piano*) above Torre Annunziata (see Fig. 1), from which lava issued and descended in the direction of Boscotrecase and Torre Annunziata. Either before, at the same time, or shortly thereafter, two other large streams issued within the same general region and descended the near-lying slopes, the one toward Trecase and the other toward Terzigno. On the morn-

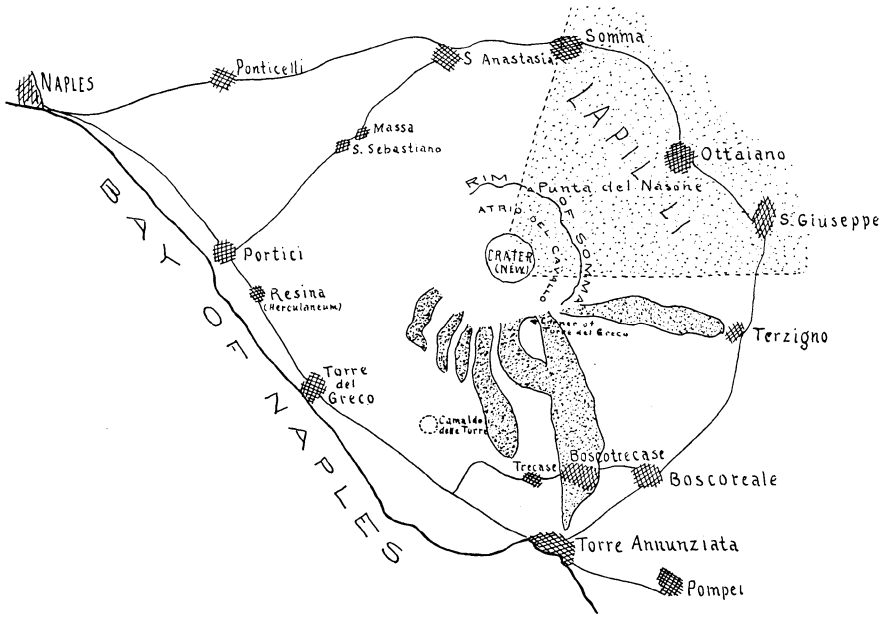

FIG. 1.—Sketch map of Vesuvius and surroundings (areas of lava streams and of lapilli distribution, approximate only).

ing of the 8th the greatest of the lava streams was making its way through Boscotrecase, and before nightfall it had enveloped the city and was on its way down the *vallone* to Torre Annunziata. It came to a halt at the *camposanto* in the outskirts of that city.

Apparently simultaneously with the emission of lava from the new *bocche* a series of violent explosions partly destroyed the central crater, and sent small fragments of lava, lapilli, and ash high into the air, to be carried by a westerly wind over the towns east and

northeast of the mountain. Ottaiano, San Giuseppe and Somma, which hug the northeastern and eastern base of the volcano, suffered most, being in part buried under some three feet of ejectamenta. Nola and Terzigno also suffered heavily, while a leaden sky and a fall of fine cinder were almost universal throughout a fan-shaped area extending at least to the Adriatic and roughly limited to the north by Campobasso and to the south by Avellino and Bari (see Fig. 2).

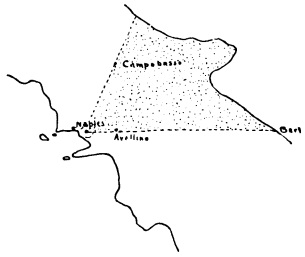

FIG. 2.—Sketch map to show the distribution of lapilli and ash from the principal explosions of the eruption.

The principal loss of life was in San Giuseppe, where in their terror the people crowded into the little church to prostrate themselves before the altar, just before the roof fell from the burden of ash upon it. Many others of the weak house-roofs of heavy tiling (wholly unfitted for such a neighborhood) also collapsed, and in some cases with resultant loss of life. The Circumvesuvian Railway and the line from Naples to Salerno were blocked by the accumulation of ash; though upon the last-mentioned traffic was resumed within twenty-four hours. With the outflow of the great lava streams the violence of the explosions within the crater began to wane (see Fig. 8).

Conditions in Naples.—The shifting winds carried the later and finer ash-fall for much of the time in the direction of Naples. On the morning of the 11th trains entered Naples from Caserta through a cloud so dense that the impression of a tunnel was produced, though the sun was high in an otherwise clear sky. On this day workmen were dismissed from the shops along the water front on account of the darkness; and business in the city, already almost paralyzed, practically ceased through the closing of the shops along the main streets. The exodus of the great body of tourists had been accomplished largely on the 8th, though with much confusion and a greatly augmented train service, the result being that on the following morning many of the grand hotels dismissed their servants. Large bodies of troops, increased by levies from other cities, armed with shovels, were promptly sent to all the afflicted

cities east of the mountain, and with fire companies, *carabinieri*, and the numerous refugees did excellent work in rescuing the wounded and in digging out the railway. Artillery wagons loaded with bread supplied the homeless who still remained in the partly buried cities. By the 15th railway communications had been established between Naples and Ottaiano.

In Naples the roof of the market of Monte Oliveto and a few other poorly constructed houses collapsed from the weight of ash,

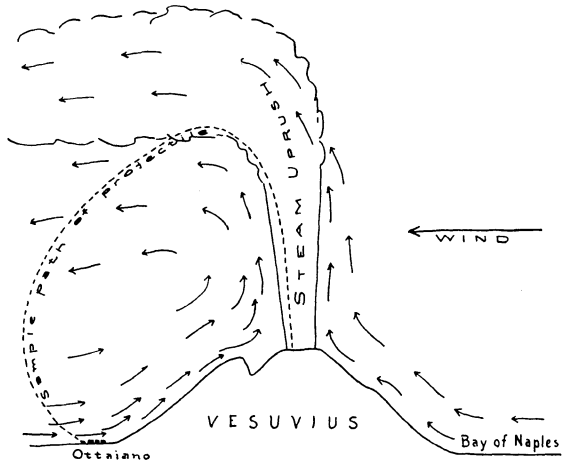

FIG. 3.—Diagram to illustrate the courses of air currents and of projectiles near Vesuvius during the grand stage of the recent eruption.

in the first mentioned instance with considerable loss of life. The principal inconvenience to the people from the falling cinder was to the eyes, which had to be protected with glasses, celluloid plates, or some other device; and of people of the better class upon the streets the greater number carried extended umbrellas for better protection. For a number of days, and until a shifting wind again brought the bright sunlight, the streets were occupied by religious processions following effigies or pictures of San Gennaro, the patron of the city.

In contrast with the eruption of 1872, the late outburst offered little opportunity for observing its developments. The constantly shifting light winds kept Naples and nearly the whole western and northern circumvesuvian country shrouded in ash for most of the

time; and no such excellent photographs as were taken in 1872 appear to have been secured.

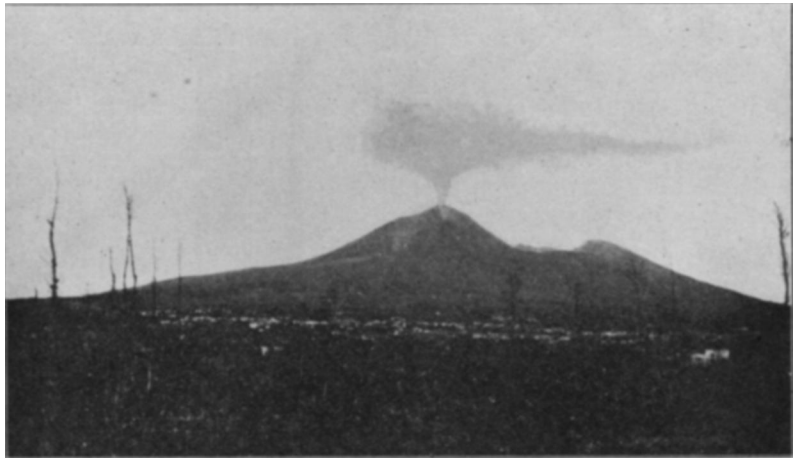

FIG. 4.—View of Vesuvius from the south, before the eruption of 1906.

FIG. 5.—View of Vesuvius from the west, before the eruption of 1906.

The electrical phenomena.—An English acquaintance, in whose statements the writer reposes confidence, reported to him that on the morning of the 8th, when the large lava stream was overrunning Boscotrecase, he followed the margin of the stream a considerable distance in the direction of the crater. Almost continuous flashes of lightning seemed to pass from the overhanging cloud nearly straight downward toward the lava; and, if appearances were to be relied upon, at no great distance.[1] On the 15th, when the writer attempted to reach the new *bocca* by following up the stream of lava from Boscotrecase, changes in the direction of the wind left him for considerable periods enveloped in the ash cloud with surrounding darkness too great for following the bad footing over the scoriaceous surface, thus necessitating long delays. At elevations in excess of 1,400 feet above Torre Annunziata heavy rumblings were heard at intervals of from six to nine minutes, and in apparent correspondence with the rhythmic uprush of steam and ash from the main crater. Before the envelopment by the ash cloud the direction of the crater had been ascertained to be in close correspondence with the steepest slopes. The *boati* always began in this direction as low continuous rumblings, like the rolling of heavy wagons over hard and irregular pavements; but they soon moved away to the southward and were transformed into reverberating crashes of thunder so resembling those of a heavy electrical storm as to be unmistakable. In a favorable shift of the wind an altitude of 2,200 feet was reached, when a quick change again brought the black ash cloud and a patter of lapilli, so that further progress (now wholly over fresh lava) was impracticable.

Pliny mentions that in 79 almost incessant lightning flashes accompanied the eruption. The rhythmic *boati* of Vulcano during its great eruption of 1888–89 lacked these striking electrical features, at least at the time the volcano was visited by the writer in April, 1889; and apparently a smaller proportion of water vapor was characteristic of the eruption. Professor Palmieri, the former director of the Vesuvian Observatory, gave careful study through many years to the electrical phenomena attending Vesuvian eruptions,

[1] A friend who was in Pompeii during the great outburst of the 7th has emphasized the grandeur of the electrical phenomena.

including the important one of 1872.[1] By putting up a conductor in the ascending current of steam he was able experimentally to show

FIG. 6.—View of Vesuvius during the eruption of 1906 (earlier stages). Stage of April 5.

Fig. 7.—View of Vesuvius during the eruption of 1906 (earlier stages). Later than Fig. 6, probably on April 7.

[1] Luigi Palmieri, *Elettricità negl' incendi vesuviani, studiata dal* 1885 *fin' ora con appositi instrumenti. Lo spettatore del Vesuvio e dei Campi Flegrei.* (Naples, 1887; pp. 77–79.)

that the steam as it is condensed by expansion to water vapor becomes positively electrified. Many samples of the Vesuvian *sabbia* from different localities when washed and heated were found to become negatively electrified. He thus found an experimental explanation for the origin of the atmospheric electricity developed during eruptions.

Disturbances of the sea.—On the 5th of April, when the violent stage of the eruption may be said to have commenced, the Bay of Naples is said to have been in unusual agitation, without apparent explanation of the weather conditions of that or earlier days. On the 6th a tidal wave struck the "Barbarossa" one day out from New York en route to Naples. It seems unlikely that either of these phenomena was directly the result of disturbances within the crater of Vesuvius, and it is far more probable that they were attributable to a more or less distant seaquake, which we may be able to locate when the next report of the seismological stations co-ordinated under the British Association has been issued. The time of the Vesuvian eruption falls so nearly in coincidence with the earthquakes of California, Hawaii, and Formosa that relationships of tidal disturbances are otherwise difficult to trace.

FIG. 8.—View of the "Pine Cloud" over Vesuvius on April 11. View taken from Ponte della Gatta looking over the ancient *bocca* of Camaldali della Torre.

Increased activity of the fumaroles in the Solfatara.—It was reported that the fumaroles of the Solfatara showed increased activity during the eruptive phase of Vesuvius. Having last visited them in October, 1905, the writer was able to confirm this by a visit made on April 16 during the closing stages of the main eruption. The vapors which issued from the main fumarole on the later date rushed up with a hissing sound, and in a volume which resembled that from the escape-valve of a locomotive. The services of the attendant, who had been accustomed to stimulate the fumarole with torches, had become unnecessary, and he had deserted his post.

FIG. 9.—View of the main lava stream of 1906. Above Boscotrecase.

The lava streams.—Three large and several smaller lava streams issued from Vesuvius during the recent eruption. The one which caused the greatest damage appears to have been the largest, and flowed from a *bocca* near the *piano* above Torre Annunziata to the cemetery on the outskirts of that city, completely enveloping the city of Boscotrecase and burying it to a roughly estimated average depth of 12 feet (see Figs. 9–12). Above an altitude of about 2,200 feet and almost immediately above the corner monument of Torre del Greco (see Fig. 1), this stream sent off a branch to the westward, which branch, following the course of a diverging *vallone*, was again reunited to the main stream near the altitude of 1,500 feet. The

bocca of this principal stream is above the monument referred to and probably near the *piano*.

A second large stream, which probably issued from a *bocca* somewhat farther to the west, passed over vineyards and isolated houses, and descended to a point near Trecase and only 670 feet (vertically) above Torre Annunziata in a direction a little west of north (see Fig. 1). Fig. 14 shows where this stream had passed through a grove of small stone pines, some of which it broke off and carried along. The several smaller streams were all higher up upon the

FIG. 10.—View of the main lava stream of 1906. In the *vallone* below Boscotrecase. (The lava filled the valley with arching upper crust which collapsed after outflow of lava beneath.)

slopes and in the vicinity of this one. They could be distinctly followed by the eye from the high point reached on the 15th.

The third large stream the writer has not personally followed, but it was reported to him by Professor Sabatini to extend in a direction parallel to and north of the narrow stream of Caposecchi (1834) and to end near Terzigno.

The streams personally examined presented a black scoriaceous surface made up of blocks irregular in shape and generally quite separate from each other, varying in size from a man's fist to great

angular pieces too heavy for a man to lift. The destruction wrought by lava to structures began by the damming back of the stream

FIGS. 11 and 12.—Views of the lava over Boscotrecase with partly buried villas projecting. (Taken April 11, 1906.)

until the structures were fractured and toppled over from the pressure exerted against them. Trees situated near but within the edge of

the stream were surrounded and remained standing. Farther within the margin, however, where the developed stresses were

FIG. 13.—View of the cone of Vesuvius on April 13, from the roof of a deserted villa above Resina. The flat dome is in contrast with the earlier pointed form.

FIG. 14.—View of the surface of the western lava stream above Trecase, where it has overrun a group of pines. (Taken on April 15.)

greater, they were snapped off and carried along upon the surface as passengers. Little if any burning resulted, though the snapped stems were sometimes found charred near the fractured surface. This immunity of inflammable objects from combustion when in contact with lava is apt to cause surprise, though simply enough explained by the insulating nature of the non-conducting lava crust.

The ejectamenta.—The events of the eruption have been so enlarged upon by the fertile imagination of an excited press that the figures given below will doubtless seem to be underestimates. Yet, while it has seldom been practicable to carry out actual measurements, owing to the irregularities of distribution, and in the deeper layers because of the necessity of extensive excavation, it is confidently believed that the figures given are generally within 15 per cent. of the true averages.

The ejectamenta may be roughly classified into lava fragments, lapilli, and ash. The lava fragments and lapilli, if we except the area above the atrium and hence near to the crater, have been restricted in their distribution to the area northeast of the mountain (see Fig. 1), whither they were carried by the wind on the 7th and 8th, during the climax of the outburst. In the belt of cities encircling the mountain lapilli begin to be observed near Somma, and farther east are found almost throughout the thick deposit. Their southern limit, probably near Terzigno, has not been sought by the writer.

Section of the deposits.—The total maximum thickness of the deposits at Ottaiano and San Giuseppe may slightly exceed three feet. The deposits consist of a lower layer, a few inches in thickness, made up of black scoriaceous lava fragments, the largest of which are an inch or more in diameter (in the press reports red-hot blocks weighing 200 kilos descended upon the town). This layer is succeeded by gray lapilli mixed with ash, the former decreasing in size more or less uniformly toward the top. The uppermost inch of the deposit shows in great perfection the succession of colors characteristic of the closing stages of an eruption. The dull gray which succeeds the black lower layer, and which constitutes the major portion of the deposits, here changes into the penultimate thin red layer, the *sabbia rossa*, which was falling upon the 11th and 12th.

Upon this is the surface layer of nearly white impalpable ash. Von Buch, who observed the quite important Vesuvian eruption of 1794, has given the order of colors, which, he states, was then recognized as characteristic, to be black, bright gray, and white.[1] The falling of the *sabbia rossa* during the late eruption was joyously hailed by the Neapolitans as the beginning of the end.

This red ash is probably of the same general characters as the gray underlying material, save for its finer state of subdivision and the greater oxidation of the contained iron. Its fall appears to indicate that, having been long suspended in the higher layers of the vaporous atmosphere above the crater, the diminution in violence of the uprushing steam has left it without support and allowed it to settle. The ultimate layer of nearly white material appears to be still more finely divided.

Effect of the projectiles upon windows.—The windows of Ottaiano and San Giuseppe afford material for an interesting study. On the sides of houses opposite the mountain they were broken in apparently much more generally than on the side facing it, and even when protected from falling blocks by deeply set casings. In several of the windows specially examined possibility of reflexion from neighboring walls was excluded, and in all cases rather improbable. Sometimes almost entirely broken out, in other instances they presented only a few cleanly cut holes almost perfectly circular in form, and generally between two and three inches in diameter. These holes were wholly devoid of radial fractures. Sometimes two or more holes overlapped, but always with the same cleanly cut outlines. In a number of cases the circular crack appeared, but with the inclosed disk still in its place to indicate that the missile had rebounded. The holes are clearly much larger than the flying missiles which produced them. The large amount of ash in the air at the time of the writer's visit to these cities made photographing difficult, and the exposures from these windows were unfortunately failures.

The explanation of these fractured windows on the sides of buildings away from the volcano is probably to be found in the inrush of air from all sides toward the crater to replace that removed by

[1] L. v. Buch, *Gesammelte Schriften*, Vol. I, pp. 397–404.

the great uprush of the steam. In times of grand eruption Vesuvius becomes a gigantic steam injector (see Fig. 3). As already stated, the light wind blew at the time of the grand paroxysm from the southwest, or over the crater toward Ottaiano. On the side toward the bay the force of this current would simply be increased, whereas on the Ottaiano side the southwest wind would be replaced near the surface by a contrary current blowing in the direction of the crater. From the fact that lapilli even are not found west of the crater at points below the *piano*, it is clear that projectiles which fell at Ottaiano must have followed a course determined largely by air currents, and presumably similar to that indicated in the diagram. That they reached the ground in directions inclined at fairly flat angles in the direction of the volcano would appear to follow from the damage done to the upper portion of windows protected by casings nearly or quite a foot in depth.

The ash layer to the north and west.—To the west of Somma, and along the shores of the bay only ash is found. Its depth may reach six inches between Portici and Torre del Greco, though elsewhere it is generally considerably less. Higher up on the slopes its thickness increases until at the observatory it attains a thickness of perhaps ten inches, and with it are associated extremely fine lapilli.

In Naples the depth of the ash deposit hardly exceeded an inch, certainly not an inch and a half. The collapse of the roof of the market of Monte Oliveto, and of a few other buildings in Naples, is adequately explained by the high specific gravity of the ash and the weak construction of the buildings. The agriculture of all this northwestern, western, and southern belt will quickly recover from the loss which it has sustained. As regards Somma, Ottaiano, San Giuseppe, and to a less extent the more distant cities to the northeast of the mountain, a considerable time must probably elapse before the soil will again become productive.

The truncation of the cone.—It is impossible at this writing to give accurate figures concerning the reduction in height of Vesuvius; but that the cone has been reduced to near the level of the Punta del Nasone, the highest point of Somma, appears from views of the mountain.[1] It was reported in the newspapers, upon the

[1] Such data are illusory and later measurements show the truncation to have been much less.

authority of the director of the Vesuvian Observatory, that this truncation amounts to 250 meters, or about 800 feet; but when the writer visited the observatory on the 12th, Professor Matteucci stated that he had never given out this estimate. The height of the cone before the eruption was not far from, though probably in excess of, 4,265 feet (1,303 meters on the military map of 1900), while the Punta del Nasone reaches 3,779 feet.

Truncations of the same order of magnitude have occurred in 1631 and 1794.[1]

In place of the beautiful outlines which the cone of Vesuvius presented before the recent eruption (see Figs. 4 and 5), it now shows a flat dome corresponding to the larger crater and the wider radius of distribution of the ejectamenta (see Fig. 13). Its somber hue is replaced by the dim gray color of sand which seems to extend almost to its base, where before was the rich green of a sub-tropical vegetation.

Apparent relationships of events.—The recent eruption of Vesuvius belongs to the paroxysmal rather than to the explosive type, though no sharp line divides the two. The order of events has been that generally recognized to be characteristic of this type. Starting in this instance from almost absolute repose in October, 1904, activity in the crater increased gradually, and lava began to dribble from a *bocca* high up upon the inner cone late in May of the following year. Both these manifestations of returning life increased more or less steadily until early in April, 1906, when the grand stage was ushered in. It may be presumed that during these initial stages lava found its way to the *bocca* from which it issued through a comparatively narrow channel, since otherwise the weak inner cone, especially in its upper portion, could hardly have withstood its hydrostatic pressure. This channel must have been slowly but constantly widened through the gradual fusion of its walls, thus augmenting both the quantity of lava which could reach the *bocca* and the hydrostatic pressure of the column upon the now weakened walls. When the cone was no longer able to withstand the pressure, it was cleft radially to the accompaniment of light earthquakes,[2] with partial

[1] J. Roth, *loc. cit.*

[2] These earthquakes were felt in Naples, one in the late evening of the 7th, and

destruction of the crater and great reduction in its height. The exposure within the fractured crater of larger surfaces of the hitherto imprisoned lava allowed of the more rapid escape of steam, which produced much more violent explosions. The fragments and lapilli, lifted by the uprushes of steam, were distributed by a south-westerly wind over the cities at the northeastern base of the mountain and beyond. The clefts opened being on the south side of the cone, *bocche* were there formed and the lava streams following the slopes descended respectively toward Trecase, Boscotrecase, and Terzigno. The rapid descent of these great lava bodies is explained both by the steep slopes and by the head under which they flowed—the difference in elevation of the new *bocche* (near the *piano*) and the old one high up upon the central cone. The pressures now relieved, the closing phases of the eruption followed in the slow escape of the remaining steam within the lava of the crater, now doubtless covered with ash shaken down from the walls. Much of this ash was probably again and again sent up to fall in considerable part within and about the crater, the finer portions only making contribution to the comminuted material derived from the rapid expansion of the steam within the lava itself.

Mutual relationships of tectonic movements and volcanic eruptions.—Few facts have been more securely established by experience than the lack of correspondence in time of great earthquakes and volcanic eruptions, in those regions where both are common. It has even been shown by Milne that central Japan, where there are many active volcanoes, is singularly free from earthquakes. Yet, while there is apparent lack of quick sympathetic response of the one phenomenon to the other, evidence is not wanting that the influence of the one *slowly* makes itself felt upon the other. Milne has shown that the West Indian earthquakes have been broadly related in time to the greater outbursts of its volcanoes.[1] Suess[2] long ago

two in the early morning of the 8th. It may be significant that there were three main lava streams, all of which appear to have started at about this time and apparently from separate, though near-lying, *bocche*.

[1] John Milne, "Seismological Observations and Earth Physics," *Geographical Journal*, London, Vol. XXI (1903), pp. 15 ff.

[2] Ed. Suess, "Die Erbeben des südlichen Italien," *Denkschriften der Wiener Akademie, Mathematisch-Naturwissenschaftliche Klasse*, Vol. XXXIV (1872), pp. 1–32.

pointed out that the greatest of Calabrian earthquakes, that of 1783, followed upon grand eruptions of both Vulcano and Etna. The new eruption of Vesuvius, the greatest since 1631, follows close upon the greatest earthquake in near-lying territory for more than a century, not long after which had occurred the really important eruption of 1794.

ROME,
April 23, 1906.